Wheat

Gramineae *Triticum* sp.

Source: Magness et al. 1971

Wheat is the most important food grain of the temperate zones - both north and south. World acreage in wheat is estimated at near 500 million with near 60 million acres in the United States. Production in the United States was 1,524,340,000 bushels in 1967.

Wheat has been a food crop for mankind since the beginning of agriculture. Carbonized grains dating to at least as early as 6750 B.C. have been found in Iraq, and many other findings in Eastern Mediterranean countries are nearly as old. The Middle East is probably the area of origin, and wheat apparently spread throughout Europe not later than the Stone Age.

Wheat is essentially a cool season crop that thrives best at preharvest temperatures averaging aroudd 600 F. The minimum frost-free growing season is about 100 days. In continental United States wheat is grown in every state although production in New England is minor. From 15 to 20 or more inches of precipitation are necessary for annual cropping. In some areas with not more than 10 to 15 inches of precipitation wheat is grown once in 2 years, with the land kept free of vegetation one of the years to accumulate moisture in the soil.

The wheat plant is an annual grass. It is mainly grown as a winter annual in milder climates, with seeding in the fall and harvest from June through August depending on the length of the winter. In areas with rigorous winter climates it is mainly spring seeded. Planting is as earlv as soil can be worked, and harvest is in late summer and early fall.

In early growth stages the wheat plant consists of a much compressed stem or crown and numerous narrowly linear or linear-lanceolate leaves. Leaves are mainly near glabrous. Buds in the leaf axils below the soil surface grow into lateral branches termed tillers. From both the main crown and the tillers, elongated stems develop later and terminate in a spike or head in which the flowers, and finally the seed or grain, develop. In fall-seeded wheat the plant usually remains in the rosette stage throughout the fall and winter, sending up the elongated stems in late spring. In spring-seeded wheat the rosette period may be short, and tillering is usually much less than in fall plantings. During late fall and early spring, fall-seeded wheat can be lightly pastured without greatly reducing grain yields, and this is frequently done. The pasturage at this stage is nutritious and highly palatable.

Stems of wheat reach from 18 inches to 4 or more feet in height depending on kind and growing conditions. The spike or head may be from less than 2 inches to 4 or 5 inches long. Both stems and spikes from the latest-formed tillers are usually somewhat smaller than those of the earlyformed tillers.

Spikelets develop at nodes in the spike and in these spikelets the flowers and seeds develop. Spikelets vary in number from 10 to 30 per spike and each develops from 1 to 5 flowers and seeds, depending on the kind. Density of spikelets and overall shape of the spike also vary. The flower consists of two outer membranous tissues, one termed lemma and one palea, which enclose the stamens and the single ovary which develops into the seed or kernel. Together these

are termed the glumes, and they continue to enclose and completely cover the developing seed. In awned varieties, the awns or beards are at the terminal of the lemma. The palea is membranous and awnless. In most wheats the lemmas and paleas are separated from the kernels in threshing - forming the chaff. In spelt and emmer, formerly grown to a very limited extent for feed in this country, they continue to adhere to the seed following threshing.

The wheat grain or kernel is roughly ovate or egg shaped and from 0.16 to 0.4 inch in length depending on kind. The dorsal surface is generally smooth and rounded but the ventral surface is creased. At the apex a brush consisting of short hairs is generally present. Color of the kernel varies from dark red through light brown - classed commercially as red wheat, - to white, cream or yellow - classed commercially as white, wheat, - or amber, in duram wheat.

The wheat kernel is made up of three main parts: (1) The outer covering consists of several distinct cell layers aild is the bran - separated from the flour during most milling processes. It comprises about 12 percent of the kernel weight. (2) The endosperm consists mainly of starch and makes up about 85 to 86 percent of the kernel. It is the portion present in white flour. (3) The germ, or embryo, expands into the new plant at and following germination. It makes up only about 2.5 percent of the kernel and is also separated out in most milling processes.

Botanical Classification of Wheat

In U. S. Dept. of Agr- Technical Bulletin 1287 titled *Classification of Triticum species* and *Wheat Varieties Grown in the United States*, wheat is classified into 10 species of *Triticum*. Six of these are cultivated and four are noncultivated, or rarely so. The most important species, *T. aestivum* L., includes five subspecies. Species and subspecies are briefly characterized as folows:

Common wheat, *T. aestivum* L. subsp. *aestivum*. This subspecies has a long, slender spike which is somewhat flattened. Spikelets are 2 to 5 flowered, relatively far apart on the stem and nearly erect. Awns are either lacking or less than half an inch long. Stem centers are generally hollow but may be pithy. Leaves are more narrow than in some other wheats. Kernels may be red or white, hard or soft. This is the source of most of the wheat varieties cultivated in the United States. Over 200 such varieties have been described, with near 100 now cultivated. They may be either spring or winter type and comprise nearly 95 percent of the wheat grown in this country. Principal use is for flour.

Club wheat, *T. aestivum* subspecies *compactum* (Host) MacKey.

Varieties of this subspecies may be either of winter or of spring type. Stems vary in height but are generally stiff. Spikes are short, usually under 2.5 inches in length, very compact and flattened. Spikelets usually contain 5 flowers and spread at near right angles to the rachis or stem. Spikelets are generally awnless, but sometimes awned. Kernels are small, flattened, have a very shallow, narrow crease, and a short brush. About 5 varieties were grown on nearly 2,000,000 acres in 1959 - mostly in the Pacific Northwest. Principal use is flour manufacture.

Durum wheat, *T. durum* Desf.

Varieties of this species grown in the United States are all spring wheats. Stems generally are pithy internallv and leaves are relatively broad. Spikes are intermediate in length and flattened. Awns are nearly always present and are long and coarse white, yellow or black in color. Kernels

are white or red, usually long and pointed, very hard and translucent with angular sides and a short brush. Durum wheat is used mainly for the manufacture of semolina which is made into macaroni, spaghetti and related products. About 8 varieties are grown on more than 2 million acres in this country - mainly in North Dakota and neighboring states.

Spelt, *T. spelta* L.

Spelt may be either winter or spring in habit and awned or awnless. The spike is long and narrow. Spikelets are two-kemeled and upright, closely pressed to the rachis or central stem. Kernels are red, long, flattened, with a sharp tip and a narrow, shallow crease. They remain enclosed in the glumes after threshing. Spelt was formerly grown in the United States on a small acreage for livestock feed but bas now almost disappeared from cultivation.

Emmer, *T. dicoccon* Schrank.

Emmer is one of the most ancient of cultivated cereals. It may be either winter or spring in habit. Leaves generally are pubescent. Spikes are very dense and flattened laterally. Spikelets generally contain two flowers and generally are awned. The red or white kernels remain enclosed in the glumes after threshing. They are slender and acute at both ends. Emmer was formerl rown in the United States for feed on a limited acreage but now has substantially disappeared from cultivation.

Wild emmer, *T. dicoccoides* (Koern. ex Ascb. & Graebn.) Aaronsohn.

This plant grows in the area from Palestine to the Transcaucasia in U.S.S.R. It is a winter annual with loose, flattened spikes bearing long, stiff awns. Spikelets fall from the fragile spike at maturity. Spikelets are large, usually with three flowers but developing only two kernels. Wild emmer appears not to be cultivated.

Poulard wheat, *T. turgidum* L.

Poulard wheats may be winter or spring in habit. Stems are usually tall, thick, and solid or pithy. Leaves are broad. Spikes are long and dense, sometimes compound or branched. They are near square in cross-section, with long awns. Kernels are short, ovate and humped in shape. Poulard wheat is closely related to durum but is somewhat inferior in this country both in production and in macaroni making quality, so has practically disappeared from cultivation. It is grown quite extensively in Mediterranean countries.

Polish wheat, *T. polonicum* L.

Polish wheat varieties are spring wheats with tall stems. Spikes are large, open or dense, awned, and square or rectangular in cross-section. Kernels are very long, narrow, and hard. They thresh free of the glumes. While grown extensively in Mediterranean countries, Polish wheat has proved inferior in the United States both in yield and in quality for bread or macaroni products. For these reasons it has substantially disappeared from commercial production.

Persian wheat, *T. carthlicum* Nevski.

Persian wheat is of spring habit, early maturing, and somewhat resistant to fungus diseases. It has strong yellow to light red stems. Spikes are flexible, tending to lean over. While several flowers

are present in each spikelet only three usually develop kemels. Kemels are free-threshing, flinty, generally red. Persian wheat is grown in the Eastern Mediterranean Area, including southern U.S.S.R., but not commercially in the United States.

Macha wheat, *T. aestivum* subsp. macha (Dek. and Men.) MacKey

This is a late-maturing winter wheat with tall, hollow stems. Spikes vary in density from open to dense, with short awns. Kernels remain in the spikelets after threshing, They are elliptical, red, and intermediate in hardness. Macha wheat is grown in Transcaucasia, U.S.S.R., but not commercially in the United States.

Vavilovi wheat, *T. aestivum* subsp. *vavilovi* (Tuman) Sears.

This is a winter type wheat, midseason in maturity with thick, strong, stems. Spikes are medium dense to loose, and awded. Kerrnels remain in the spikelets after threshing. They are ovate, white and hard. This wheat is grown somewhat in the U.S.S.R., but not commercially in the United States.

Shot wheat, *T. aestivum* subsp. *sphacrococcum* (Perc.) MacKey.

This is an early maturing spring wheat with short, stiff stems. Spikes are awnless or short-awned and dense. They appear square in cross-section. Spikelets contain 6 or 7 flowers and develop 4 or 5 kernels. Kernels are short and almost spherical, unique among wheats, and thresh free. Shot wheat is grown in Northwest India, but not commercially in the United States.

Oriental wheat, *T. turanicum* jakubz.

This is a spring wheat, early in maturity with narrow, pubescent leaves. Spikes are long, loose, and almost square in cross-section. Awns are long and often black. Spikelets produce 2 or 3 kernels which are long, narrow, white and hard. This wheat is grown in the Mediterranean Area and the Near East, but not in the United States.

Timopbeevi wheat, *T. timopheevii* (Zbuk.) Zbuk.

This is a latematuring spring wheat with leaf blades that are pubescent on both sides. Spikes are very compact, rather short, somewhat pyramidal in shape with soft, thin, rather short awns. Spikelets usually contain two kernels. Kernels are medium long, slender and hard or flinty. The species occurs in Transcaucasia, U.S.S.R. It is not grown in the united States.

Einkorn, *T. monococcum* L.

Einkom or one-tyrained wheat is a primitive kind the cultivation of which goes back to prehistoric times. Both winter and spring forms ocur. Spikes are awned, slender, narrow, flattened, and fragile. Spikelets contain only a single fertile flower and thus produce only one seed. Seeds are pale red, slender, flattened, almost without crease, and remain in the spikelets after threshing. Einkorn is little grown at present and not at all in the United States.

Wild einkorn, *T. boeotictim* Boiss., differs little from einkorn. It grows as a native grass in the Balkans and Anatolia.

Uses of Wheat

Wheat is used mainly for food, but substantial quantities are also used as feed for livestock. Some wheat is cut for hay. Wheat grown for the grain crop may also be used for threshing formerly was an important sustainance feed for livestock. Since nearly all wheat is now combined, with the straw scattered in the field, this use is now decreased. As temporary pasturage wheat is nutritious and palatable. As a feed grain, wheat is fed to livestock either whole or after coarse grinding. In either case the feed includes the entire kernels.the barn from flour milling is also an important livestock feed, and the germ is a valuable addition to feed concentrate.

For food, most of the wheat is made into flour, the base of most baked foods as breads, cakes, etc. Macaroni is made from durum wheat. Most of the flour used in this country is white. In making white flour the bran and germ are removed mechanically and the resulting product consists essentially of the ground endosperm. Whole wheat flour is also an important food. Some of the bran and germ separated out in milling also are used as food. In addition to food and feed uses, some wheat is used as a source of starch and in the making of alcoholic beverages.

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